## REMARKS

Claims 1-13 and 22-27 are the claims pending in the application. Claims 1-13 and 22-27 are rejected on prior art grounds. Applicants respectfully traverse the prior art rejections based on the following discussion.

### I. The Prior Art Rejections

Claims 1, 5, 7-9, 22 and 24, are rejected under 35 U.S.C. 102(b) as anticipated by Pokropivny, et al. ("Pokropivny")(J. Solid State Chem., 2000). Claims 1, 3-5, 6, 22 and 27 are rejected under 35 U.S.C. 102(b) as anticipated by Sherman, et al. ("Sherman")(U.S. 3,879,504). Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pokropivny. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman in view of Becuwe ("Becuwe") (U.S. 5,034,072). Claims 7, 8 and 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sherman. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatatentable over Sherman in view of Nix, et al. ("Nix") (U.S. 3,389,025). Claims 11-13 and 26 are rejected under 35 U.S.C. 103(a) as being unpatatentable over Sherman in view of Levinthal ("Levinthal") (U.S. 4,086,110).

#### A. The Pokropivny Reference

Regarding claims 1, 5, 7-9, 22 and 24 as well as claim 10, Pokropivny fails to disclose, teach or suggest the features of independent claim 1, and related dependent claims 5, 7-9, 22, 24 and 10, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one

nanotubular structure. (See Page 3, lines 15-19; Page 4, lines 1-11; Page 6, lines 3-10; and Page 7, line 15- Page 8, line 5).

Indeed, Figures 1-7 of Pokropivny merely teaches boron nitride analogs of Fullerenes, nanotubes and Fullerites. In particular, molecules of boron and nitrogen, for example as $B_{12}N_{12}$, $B_{24}N_{24}$, and $B_{60}N_{60}$ have been proposed as boron nitride analogs of fullerenes. Importantly, these boron nitride molecules are formed in the shape of fullerenes, that is, buckeyballs, as well as nanotubes. Further, Pokropivny appears to disclose by simulation only a multilayer nanotube(s) caused by formation of five ($C_5$, $B_3N_2$) and seven ($C_7$, $B_3N4_2$) membered rings. This embodiment appears to be just a simulation not a fully enabled description of a heterogeneous, multilayered nanotube with a carbon layer and BN attached to the carbon focused on nanoelectric applications. Contrary to the assertion in the Office Action, these structures, including the nanotubes, are composed of boron nitride not carbon based energetic materials absent boron as claimed by Applicant.

In addition, please note, boron materials generally have high melting points of several thousand degrees centigrade. As a result, Applicant further asserts that it is unlikely that Pokropivny's boron nitride nanotubes are melt processible like Applicant's claimed energetic composition. Accordingly, Pokropivny does not disclose at least two elements of Applicant's claimed invention. Based on the well settled case law, a claimed invention is not anticipated by a reference if the reference does not disclose all of the elements of the claimed invention. Thus, Applicant respectfully submits that the Office Action mischaracterizes the Pokropivny invention as disclosing Applicant's energetic composition including, in part, that the high energy material is a carbon based

homogenous energetic material absent boron formed into a shape of a nanotubular structure. Indeed, and for emphasis, Pokropivny clearly teaches that the nanotube is a boron nitride nanotube not a carbon-based high energy material nanotube without boron. (See Office Action, Page 2, Second Paragraph; Pokropivny at Abstract, Pages 214, 217-220 and Figures 3-6).

In contrast, and for emphasis, as discussed in the previous amendments of January 4, 2007, and June 7, 2006, Applicants' claimed invention is an energetic composition , which includes a high energy material where the high energy material is a carbon based homogenous energetic material absent boron formed into a shape of a nanotubular structure For example, the high energy material includes a carbon based explosive composition, which may be selected from at least of RDX, TNT and HMX. However, and for emphasis, Pokropivny only discloses nanotubes made from boron nitride and maybe carbon, which is not an homogeneous, melt processible energetic material. Thus, Pokropivny clearly does not teach or suggest, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. (See above).

An attempt to substitute Pokropivny' boron nitride nanotube structure for Applicant's high energy material nanotubes could not yield a melt processible, energetic material absent boron like Applicant's inventive composition. Therefore, Applicant's invention is structurally distinct from the conventional Pokropivny structure. (See Application above).

Based on the above, the Applicants traverse the assertion that Pokropivny discloses or teaches Applicants' invention of independent claim independent claim 1, and related dependent claims 5, 7-9, 22 and 24.

Regarding claim 10, for at least the reasons outlined above, Applicants submit that Pokropivny, alone or in combination, does not disclose, teach or suggest, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure as recited in independent claim 1, and related dependent claim 10.

Further, please note, Applicant agrees with the Office Action that Pokropivny does not disclose a nanotube aligned along a direction of increased burn rate. However, Applicants traverse the assertion that aligning a nanotube structure along a direction of increased burn rate in view of Pokropivny would be obvious to one of ordinary skill in the art. Indeed, Applicants' inventive composition is focused on burn rate, which requires that rocket motors burn at a certain pressure in part due to alignment of the nanotubes. At least with regard to the Office Action's relied upon embodiment of a simulation of multilayered nanotubes containing carbon, boron and nitrogen, Pokropivny is focused on electronic properties of nanotubes not burn rate like Applicant's invention. Nothing in Pokropivny discloses, teaches or suggests alignment of nanotubes along a direction of increased burn rate, for example, as recited in claim 10. (See Office Action, Page 4, lines 1-7; and Pokropivny at Page 218, First Column, Second Paragraph).

B. The Rejection Based on Sherman

Regarding claims 1-3, 5, 6, 22 and 27 as well as claims 7, 8 and 23-25, Sherman fails to disclose, teach or suggest the features of independent claim 1, and related dependent claims 2, 3, 5-8, 22-25 and 27, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. (See Page 3, lines 15-19; Page 4, lines 1-11; Page 6, lines 3-10; and Page 7, line 15- Page 8, line 5).

Indeed, Figures 1-4 of Sherman merely teach a conventional method, and related structure, for injection molding of explosive and pyrotechnic material for improved reliability of the explosive material by reducing shape induced material interface problems. In particular, the method includes, in pertinent part, mixing solid particles, which have a diameter range of 2 microns to 50 microns, with an elastomer or oil to form an apparent homogeneous mixture. The mixture is injected into small, elongated tubes (what the Examiner analogizes to Applicant's nanotube structures) under pressure where the mixture cures sometimes with the use of a curing agent. Importantly, particles having a maximum diameter from 2 to 50 microns are "preferred" as it is "preferred" that the largest diameters of the particles not exceed 1/10 of the diameter of the "extremely small" diameter tube into which the mixtures are rejected. Accordingly, the diameter of the "extremely small" diameter tubes are at least 200 microns. At this size range, the tubes are in the hundred micron size (please note, 1 millionth meter is equivalent to 1 micron) range not in the nano size (please note, 1 billionth meter is equivalent or 1 millimicron) diameter range as asserted in the Office Action. To be sure, it is generally known that nanotube structure technology did not at least exist at the manufacturing level

in the early 1970s and, in particular, the year of the filing date of the Sherman application, that is, 1973.

Second, as indicated above, the mixture is simply injected into the small diameter tubes where the mixture cures. Although the particles may be composed of energetic materials, the small tubes are not formed from energetic material into nanotube shaped configurations, which are melt processible. Accordingly, Sherman also does not disclose at least two elements of Applicant's claimed invention. Therefore, the claimed invention is not anticipated by the Sherman reference because the reference does not disclose all of the elements of the claimed invention. Thus, Applicant respectfully submits that the Office Action mischaracterizes the Sherman invention as disclosing Applicant's energetic composition including, in part, that the high energy material is a carbon based homogenous energetic material absent boron formed into a shape of a nanotubular structure. Indeed, and for emphasis, Sherman only teaches micron sized tubes containing, at best, explosives where the micron sized tubes are not formed from an energetic material, let alone, a carbon-based high energy material nanotube without boron like Applicant's claimed invention. (See Office Action, Page 3; Sherman at Abstract, Column 1, lines 10-33; column 2, lines 1-41; Column 3,lines 30-54; and Figures 1-4).

In contrast, and for emphasis, as discussed above, Applicant's claimed invention is an energetic composition , which includes a high energy material where the high energy material is a carbon based homogenous energetic material absent boron formed into a shape of a nanotubular structure, whereas Sherman does not disclose any nanotube structure, let alone, a carbon based homogenous energetic material absent boron formed into a shape of a nanotubular structure Thus, Sherman clearly does not teach or suggest,

including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. (See above).

An attempt to substitute Sherman's hundred micron diameter structure potentially containing an explosive material for Applicant's high energy material nanotubes would not yield a melt processible, energetic material absent boron like Applicant's inventive composition. Therefore, Applicant's invention is structurally distinct from the conventional Sherman structure. (See Application above).

Based on the above, the Applicants traverse the assertion that Sherman discloses or teaches Applicants' invention of independent claim independent claim 1, and related dependent claims 2, 3, 5, 6, 22 and 27.

Regarding claims 7, 8 and 23-25, for at least the reasons outlined above, Applicants submits that Sherman, alone or in combination, does not disclose, teach or suggest, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure as recited in independent claim 1, and related dependent claims 7, 8 and 23-25.

Further, please note, Applicant agrees with the Office Action that Sherman does not disclose disclose the features of any of dependent claims 7, 8 and 23-25. However, regarding claims 7 and 8, Applicants traverse the assertion that modifying the composition of Sherman to include an inert material and form Application's claimed invention in view of Sherman would be obvious to one of ordinary skill in the art. Applicants further traverse the assertion that modifying the composition of Sherman depending on the size of the particles in order to provide for nanotubes of a specific diameter would also be obvious to one ordinary skill in the art. Indeed, Applicants'

inventive composition is focused on using energetic nanotubes to produce enhanced burn rates, whereas Sherman is focused on an injection molding process for improved reliability of the explosive material by reducing shape induced material interface problems. Nothing in Sherman discloses, teaches or suggests nanotubes, let alone, for example, the features found in claims 7, 8 and 23-25 of Applicant's claimed invention. (See Office Action, Page 4, Last four lines-Page 5, line 9).

C. The Rejection Based on Sherman in view of Becuwe

Regarding independent claim 1, and related dependent claim 4, first the references, separately, or in combination, fail to disclose, teach or suggest a reason or motivation for being combined.

In particular, as previously discussed, Becuwe pertains to gun powder and propellant formulations, which lower the flame temperature of the gunpowder and reduce firearm barrel erosion. (See Becuwe at Abstract; Column 1, lines 10-20 and Column 3, lines 31-37).

Nothing within Sherman, which pertains to an injection molding process for improved reliability of the explosive material by reducing shape induced material interface problems, suggests propellant formulations for reducing flame temperature and firearm barrel erosion as disclosed in Becuwe (See above).

Therefore, one of ordinary skill in the art would not have combined these references absent hindsight.

Second, even assuming that the references would have been combined, Sherman, as indicated above, does not disclose, teach or suggest the features of independent claim

1, and related dependent claim 4, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. (See above).

Indeed, Applicant agrees with the Office Action that Sherman does not disclose, teach or suggest that the energetic composition further includes a melt temperature lowereing component as recited in claim 4. (See Office Action, Page 4, Lines 9-17).

Becuwe is also deficient and does not make up for the deficiencies of Sherman.

Instead, Becuwe merely recites a gun powder, including a triazole material and a gunpowder forming ingredient, in the form of powder without any nanotubes, let alone, nanotubes composed of a high energetic material. Thus, Becuwe clearly does not teach or suggest, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. Since Becuwe does not include any nanotubular structure, Becuwe is deficient and thus does not teach the limitations of dependent claim 4. (See Becuwe at Abstract; Column 3, lines 45-60; and Column 5, lines 20-38).

For at least the reasons outlined above, Applicant respectfully submits that neither Sherman nor Becuwe, alone or in combination, disclose, teach or suggest including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure as recited in independent claim 1 of Applicant's invention.

For the reasons stated above, the claimed invention as defined by independent claim 1, and related dependent claim 4, is fully patentable over the cited references.

D. The Rejection Based on Sherman in view of Nix

Regarding independent claim 1, and related dependent claims 9 and 10, first the references, separately, or in combination, fail to disclose, teach or suggest a reason or motivation for being combined.

In particular, Nix pertains to a propellant composition containing high energy metal in the form of multidimensional crosses, which is used as a burning rate modifier for solid propellant grains. (See Nix et al. at Abstract; Column 1,lines 20-25 and Column 2, lines 2-15).

Nothing within Sherman, which pertains to an injection molding process for improved reliability of the explosive material by reducing shape induced material interface problems, suggests propellant formulations in a multi-dimensional cross shape for being a burning rate modifier as disclosed in Nix. (See above).

Therefore, one of ordinary skill in the art would not have combined these references absent hindsight.

Second, even assuming that the references would have been combined, Sherman, as indicated above, does not disclose, teach or suggest the features of independent claim 1, and related dependent claims 9 and 10, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. (See above).

Indeed, Applicant agrees with the Office Action that Sherman does not disclose, teach or suggest that one or more nanotubular structures are substantially longitudinally aligned as recited in claim 9, and similarly claim 10. (See Office Action, Page 4, Paragraph 3).

Nix is also deficient and does not make up for the deficiencies of Sherman.

Instead, Nix merely recites a propellant composition, including high energy metal in the form of multidimensional crosses where the metal staples are incorporated throughout the grain without any nanotubes, let alone, nanotubes composed of a high energetic material. Thus, Nix clearly does not teach or suggest, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. Since Nix does not include any nanotubular structure, Nix is deficient and thus does not teach the limitations of dependent claim 4. (See Nix at Abstract; Column 1, lines 20-35; and Column 2, lines 30-Column 3, line 8).

For at least the reasons outlined above, Applicant respectfully submits that neither Sherman nor Nix, alone or in combination, disclose, teach or suggest including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure as recited in independent claim 1 of Applicant's invention.

For the reasons stated above, the claimed invention as defined by independent claim 1, and related dependent claims 9 and 10, is fully patentable over the cited references.

E. The Rejection Based on Sherman in view of Levinthal

Regarding independent claim 1, and related dependent claims 11-13 and 26, first the references, separately, or in combination, fail to disclose, teach or suggest a reason or motivation for being combined.

In particular, Levinthal pertains to an oxidizer-propellant formulation, which is insoluble in water to reduce the need for desiccants and heremetic seals with rocket motors. (See Levinthal at Abstract; Column 1,lines 10-15, lines 32-48 and lines 55-61).

Nothing within Sherman, which pertains to an injection molding process for improved reliability of the explosive material by reducing shape induced material interface problems, suggests oxidizer- propellant formulations, which is water insoluble as disclosed in Levinthal (See above).

Therefore, one of ordinary skill in the art would not have combined these references absent hindsight.

Second, even assuming that the references would have been combined, Sherman, as indicated above, does not disclose, teach or suggest the features of independent claim 1, and related dependent claims 11-13, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. (See above).

Indeed, Applicant agrees with the Office Action that Sherman does not disclose, teach or suggest the composition as a solid propellant as recited in claim 12, and similarly claims 11 and 13, as well as claim 26. (See Office Action, Page 3, Paragraph 4).

Levinthal is also deficient and does not make up for the deficiencies of Sherman.

Instead, Levinthal merely recites an oxidizer-propellant formulation, including crystals of HMS and ammonium perchlorate without any nanotubes, let alone, nanotubes composed of a high energetic material. Thus, Levinthal clearly does not teach or suggest, including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure. Since Levinthal

does not include any nanotubular structure, Levinthal is deficient and thus does not teach the limitations of dependent claim 4. (See Levinthal at Abstract; and Column 2, line 25-Column 4, line 14).

For at least the reasons outlined above, Applicant respectfully submits that neither Sherman nor Levinthal, alone or in combination, disclose, teach or suggest including the high energy material is a carbon based homogenous energetic material absent boron formed in a shape of at least one nanotubular structure as recited in independent claim 1 of Applicant's invention.

For the reasons stated above, the claimed invention as defined by independent claim 1, and related dependent claims 11-13 and 26, is fully patentable over the cited references.

**III. Formal Matters and Conclusions**

In view of the foregoing, Applicants submit that claims 1-13 and 22-27, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary.

Please charge any deficiencies and credit any overpayment to Attorney's Deposit Account Number 50-1114.

Respectfully submitted,

Dated: 29 October 2007

Fredric J. Zimmerman
Registration No. 48, 747

Department of the Navy
Office of Counsel
3824 Strauss Ave., Suite 103
Indian Head, MD 20640-5152
(301) 744-5603